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THE NAILING OF WOOD BOXES

Tests of shipping boxes and observations of packages that have failed in service, made by the Forest Products Laboratory, have shown that the most common defect in box construction is inadequate nailing. Attempts to strengthen boxes by the use of thicker lumber without regard for nailing often only waste material. The extra wood may not be needed so much as a few more nails. As an aid in determining whether or not a box is adequately nailed, the Laboratory offers the following information.

Kind of Nails

Cement-coated nails have a holding power considerably greater than that of uncoated, and consequently 25 percent more nails of the same size are needed when smooth nails are used in place of cement coated. During recent years new developments in nail design have resulted in the deformed shank nails such as the annular grooved, spiral grooved, and screw-shank nail. These nails are not generally used for box construction but have more or less special applications.

Size of Nails

The penny size of the nail to be used is determined by the thickness of ends, sides, top, and bottom of the box, and the species of wood holding the point of the nail. The various tables on the following pages give the information necessary for such determination.

Spacing of Nails

Although the spacing designated in the nailing schedules may appear to be too close, experience has shown conclusively that the number of nails specified does not cause excessive splitting of the ends, and that the nailing is still the weakest part of the ordinary box.

Table 1.--Established nailing schedule. Thickness of sides, top, and bottom from 5/8 to 7/8 that of the piece holding the nail points.

Maximum size[1] of cement-coated cooler or sinker nails

Species of wood holding nails	Thickness of ends or cleats to which sides, top, and bottom are nailed, in inches								
	3/8 or less: Penny	7/16: Penny	1/2 : Penny	9/16: Penny	5/8 : Penny	11/16: Penny	3/4 : Penny	13/16: Penny	7/8 Penny
Group I	4	5	5	6	7	7	8	8	9
Group II	4	4	5	5	6	6	7	7	8
Group III	3	4	4	5	5	6	6	7	7
Group IV	3	3	4	4	4	5	5	6	7

Spacing of cement-coated nails, in inches

Size of nail -- penny	Points of nail held in -- End grain	Side grain
3	1	1-1/4
4	1-1/4	1-1/2
5	1-1/2	1-3/4
6	1-3/4	2
7	2	2-1/4
8	2-1/4	2-1/2
9	2-1/2	2-3/4

[1] Nails one size smaller than the size designated may be used, but should be spaced 1/2 inch closer.

Table 2.--Modified nailing schedule. Thickness of sides, top, and bottom less than 5/8 that of the piece holding the nail points.

Maximum size[1] of cement-coated cooler or sinker nails

Species of wood holding nails	Thickness of ends or cleats to which sides, top, and bottom are nailed, in inches								
	3/8 or less	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8
	Penny	Penny	Penny	Penny	Penny	Penny	Penny	Penny	Penny
Group I	3	4	4	5	6	6	7	7	8
Group II	3	3	4	4	5	5	6	6	7
Group III	2	3	3	4	4	5	5	6	6
Group IV	2	2	3	3	3	4	4	5	6

Spacing of cement-coated nails, in inches

Size of nail -- penny	Points of nail held in -- End grain	Side grain
2	1	1
3	1	1
4	1	1
5	1	1-1/4
6	1-1/4	1-1/2
7	1-1/2	1-3/4
8	1-3/4	2

Table 3.--Modified nailing schedule. Thickness of sides, top, and bottom more than 7/8 that of the piece holding the nail points.

Maximum size[1] of cement-coated cooler or sinker nails

Species of wood holding nails	Thickness of ends or cleats to which sides, top, and bottom are nailed, in inches								
	3/8 or less	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8
	Penny	Penny	Penny	Penny	Penny	Penny	Penny	Penny	Penny
Group I	5	6	6	7	8	8	9	9	10
Group II	5	5	6	6	7	7	8	8	9
Group III	4	5	5	6	6	7	7	8	8
Group IV	4	4	5	5	5	6	6	7	8

Spacing of cement-coated nails, in inches

Size of nail -- penny	Points of nail held in -- End grain	Side grain
4	1-1/4	1-1/2
5	1-1/2	1-3/4
6	1-3/4	2
7	2	2-1/4
8	2-1/4	2-1/2
9	2-1/2	2-3/4
10	2-3/4	3

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Box Woods Grouped According to Nail-Holding Qualities and Other Properties

The wood commonly used in box construction may be divided, according to nail-holding ability and other desirable properties, into four groups. All the species within each group can be used interchangeably as far as the thickness of material and the size and spacing of nails are concerned.

Group I

Aspen (popple)
Baldcypress
Basswood
Buckeye
Butternut
Cedar
Chestnut
Cottonwood
Cucumbertree
Fir, alpine
Fir, balsam
Fir, California red
Fir, grand
Fir, noble
Fir, silver
Fir, white
Magnolia
Pine, jack
Pine, lodgepole
Pine, ponderosa
Pine, red (Norway)
Pine, sugar
Pine, white
Redwood
Spruce
Willow
Yellowpoplar

Group II

Douglas-fir
Hemlock
Larch (tamarack)
Pine, southern yellow

Group III

Ash, black
Ash, pumpkin
Blackgum
Elm, white
Maple, soft
Sweetgum (red gum)
Sycamore
Tupelo, water

Group IV

Ash, white
Beech
Birch
Elm, rock
Hackberry
Hickory
Maple, hard
Oak
Pecan

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